

TORREYA

Vol. 26

No. 3

May-June, 1926

THE EFFECT OF INUNDATION ABOVE A BEAVER
DAM UPON UPLAND VEGETATION

FRANK C. GATES* AND EDITH C. WOOLLETT

Late in August, 1924, a beaver dam was discovered in Carp Creek, a small stream about 13 meters wide, flowing from the Gorge—a prominent scenic feature in the region of Douglas Lake, the location of the Biological Station of the University of Michigan. The water flows from Douglas Lake via an underground route and empties into the heads of the Gorge as cold, (8-12° C.), moderately swift flowing streamlets which soon unite as Carp Creek. This stream is about 1.5 kilometers in length and empties into Burt Lake.

The dam as first seen was approximately 38 meters in length and 1.3 meters above the bed of the stream. It empounded water above it a distance of about 180 meters. Time did not permit any special study of the effects upon the vegetation, beyond the general observations that the ground vegetation was quite or entirely wiped out in the upland area covered by the empounded water. Very many of the trees were dying.

By June, 1925, considerable addition had been made to the dam, so that it was now about 69 meters across. This raised the level somewhat, making the empounded water run up stream some 275 meters, furnishing a pond with an area of approximately 9700 square meters. The depth varied from a few centimeters to a maximum of 2.2 meters in a place just above the dam, from which the bottom material had been scooped to plaster the dam. In June, 1925, a subsidiary dam was commenced about 30 meters downstream causing a new inundated area in the woods.

During 1925, the vegetation of the empounded area was studied. This area had previously been streamside woods,

* Contribution No. 249 from the Department of Botany & Plant Pathology, Kansas State Agricultural College and a contribution from the Biological Station of the University of Michigan.

low wooded land, and higher wooded land. Observations were made on the herbaceous, shrubby and arboreous vegetation, including a count of the plants concerned with annotations on their state of vitality.

In the case of the herbaceous vegetation, with two exceptions, the plants formerly existing in moderate profusion had been entirely wiped out following the flooding. The fern, *Onoclea sensibilis*, was sending up its leaves thru 20 centimeters of water in two places and one patch of a species of *Carex* was maintaining its clump of leaves below 17 centimeters of water, but had not sent up a flowering shoot. A patch of *Lycopodium annotinum* was still alive under 10 centimeters of water, but was obviously dying. No other herbaceous vegetation was noted.

The case of the former shrubs was hardly any better. It was of course somewhat complicated by the fact that many—perhaps most—had been cut off or uprooted to furnish small material in the construction of the dam. Among the shrubs to be expected were:

Acer pennsylvanicum, *Acer spicatum*, *Cornus rugosa*, *Diervilla diervilla*, *Rhus radicans*, *Ribes* spp., *Salix discolor*, *Salix* spp., *Taxus canadensis*, *Viburnum cassinoides*, besides seedlings and saplings of the tree species of the area. Of these, the living seedlings or very small saplings (that is, not over 1 centimeter in diameter) were only on large logs which were projecting above the water and in no case were to be found at or in the water. Some may have died on account of inundation, others doubtless were eaten by the beavers, still others disappeared because of the fact that they were in the route of the beaver operations and were tramped on or uprooted to become part of the constructing material.

The shrubs found above the dam in the empounded water were *Amus incana*, most of which were thrifty; one very small dead plant of *Lonicera canadensis*; three patches of *Taxus canadensis*, of which two were dead and a third, altho but a trifle submerged, was dying; and a very small dying plant of *Viburnum cassinoides*.

TREES

The trees in the affected area may be conveniently taken up in groups depending upon their normal habitat. Representatives

of the beech-maple association predominated in the better upland areas. This included *Fagus grandifolia*, *Acer saccharum* and *Tsuga canadensis*, all or virtually all of which were dead or dying. Of these *Tsuga*, by far the most abundant in number in the empounded area still had 6 specimens (8%) of varying sizes that were thrifty. As these, however were all in the area empounded this year, it is to be expected that they will all be dead by another year.

The pine association was only represented by 6 large specimens of *Pinus strobus*, all of which were dead.

Because of the location of the area in the flood plain of Carp Creek, more of the lowland types of trees were found, as would be expected. These included *Abies balsames*, *Acer rubrum*, *Fraxinus nigra*, *Thuja occidentalis*, and *Ulmus americana*, typically present in low areas and *Betula papyrifera* and *Populus tremuloides*, present as a result of past fires. Of these trees *Fraxinus nigra* was scarcely affected, as was to be surmised. *Ulmus americana* also withstood inundation very well, but all the individuals of *Acer rubrum*, contrary to normal expectation were seriously affected. The case of *Populus tremuloides* is a special one in itself as these trees form the preferred food of the beavers and consequently have been largely removed. Of the many aspens previously on the area, but one dead and one thrifty remain. Of the two remaining trees, *Abies* usually grows in wet but not submerged ground and *Thuja* naturally grows under either condition. In this case both had developed in unsubmerged ground. The result of the persistent inundation has been to seriously affect 95% of the *Abies* and 71% of the *Thuja*.

FOOD HABITS OF THE BEAVER

Beaver* normally eat the bark of species of *Populus* as their preferred food. In case of scarcity of this preference, *Salix* spp., *Betula* spp., *Prunus pennsylvanica*, *Alnus* spp., *Acer pennsylvanicum*, *Acer spicatum* and certain small shrubs are felled for food. In this area, most of the woody plants cut or barked were *Populus tremuloides*. Others that had been attacked were *Abies balsamea*, *Fagus grandifolia*, *Picea mariana* (the only specimen in the vicinity, a small tree back from the stream), *Thuja occidentalis*, *Tsuga canadensis*, and *Alnus incana*.

* Bailey, Vernon. Beaver Habits, Beaver Control and Possibilities in Beaver Farming. Bulletin 1078. U. S. D. A. Oct. 18, 1922.

VEGETATION OF THE UNEMPOUNDED AREA

A study of the area below the dam for a comparison of the vegetation normal to such an area with that of the empounded area showed that the ground below the dam was densely and closely covered with herbaceous plants. Projecting above them was a moderate growth of shrubs and trees of various sizes. Indications showed that formerly all grew above the dam.

The following classified list of plants is representative of an area previous to empounding.

HERBACEOUS

| | |
|--|---|
| <i>Anaphalis margaritacea</i> | <i>Impatiens biflora</i> (in water) |
| <i>Aralia nudicaulis</i> | <i>Lycopodium lucidulum</i> |
| <i>Asplenium filix-femina</i> (both on wet ground and growing up thru a few centimeters of water) | <i>Medeola virginica</i> |
| <i>Aster macrophyllus</i> | <i>Melica striata</i> |
| <i>Actaea rubra</i> | <i>Mimulus geyeri</i> |
| <i>Botrychium virginianum</i> | <i>Polytrichum juniperinum</i> |
| <i>Caltha palustris</i> | <i>Onoclea sensibilis</i> (abundant even in water of 30 cm. in depth) |
| <i>Carex intumescens</i> | <i>Petasites palmata</i> |
| <i>Carex</i> spp. | <i>Philotria canadensis</i> (in Carp Creek) |
| <i>Circaea alpina</i> | <i>Poa compressa</i> |
| <i>Cirsium arvense</i> | <i>Polygala paucifolia</i> |
| <i>Clintonia borealis</i> | <i>Polygonatum biflorum</i> |
| <i>Dryopteris thelypteris</i> | <i>Solidago</i> sp. |
| <i>Filix fragilis</i> | <i>Taraxacum vulgare</i> |
| <i>Fragaria virginiana</i> | <i>Viola renifolia</i> |
| <i>Galium triflorum</i> | <i>Washingtonia longistylis</i> |

SHRUBS

| | |
|----------------------------|--------------------------------------|
| <i>Acer spicatum</i> | <i>Rubus triflorus</i> |
| <i>Alnus incana</i> | <i>Salix bebbiana</i> (growing high) |
| <i>Cornus canadensis</i> | <i>Salix discolor</i> |
| <i>Cornus rugosa</i> | <i>Salix</i> sp. |
| <i>Diervilla diervilla</i> | <i>Taxus canadensis</i> |
| <i>Lonicera canadensis</i> | <i>Viburnum cassinoides</i> |
| <i>Rhus radicans</i> | |



A



B



C

Views Near the Beaver Dam in Carp Creek, Cheboyan County, Michigan, 1925

TREES

| | |
|----------------------------|------------------------------|
| <i>Abies balsamea</i> | <i>Populus balsamifera</i> |
| <i>Acer pennsylvanicum</i> | <i>Populus grandidentata</i> |
| <i>Acer rubrum</i> | <i>Populus tremuloides</i> |
| <i>Acer saccharum</i> | <i>Prunus pennsylvanica</i> |
| <i>Betula papyrifera</i> | <i>Prunus virginiana</i> |
| <i>Fagus grandifolia</i> | <i>Thuja occidentalis</i> |
| <i>Fraxinus nigra</i> | <i>Tsuga canadensis</i> |
| <i>Pinus strobus</i> | <i>Ulmus americana</i> |

SUMMARY

1. The effect of inundation upon upland vegetation (beech-maple forest and lowland forest) was studied above a beaver dam in Carp Creek (an area of approximately 9700 square meters), in the vicinity of Douglas Lake, Michigan, during the second summer of its construction.

2. The original vegetation was affected seriously. All herbaceous vegetation with two exceptions was eliminated following the flooding; no shrubs except seedlings or very small saplings, on large logs at or in the water, were to be found, and 77% of all the trees in the empounded area were dead or dying.

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS.

Explanation of plate

- A. The west end of the dam contrasting the unattacked area in the background with that worked over in the foreground.
- B. Upstream over the dam. The large hemlock near the left is now in 1.3 meters of water.
- C. Appearance towards the upper end of the pond.

Photographs A by F. C. Gates; B by H. K. Gloyd; and C by Edward Breakey.

AN ECONOMICAL HERBARIUM CASE

E. D. MERRILL

I was recently obliged to provide storage space for a large and rapidly increasing herbarium, in connection with my efforts to build up at the University of California a general Indo-Malaysian and Chinese reference collection. Within a period of less than two years material in excess of 40,000 mounted